THE RISE AND FALL OF TUBERCULOSIS IN CERTAIN AMERICAN PEOPLES *

ESMOND R. LONG
From The Henry Phipps Institute, University of Pennsylvania, Philadelphia, Pennsylvania.

The history of tuberculosis in America can be traced with some accuracy. Although knowledge is scanty on the disease in colonial times, data are available for more than a century in the white population, from which the course of progression and decline can be reconstructed. In some elements of the total population, particularly certain groups of Indians and Negroes, tuberculization has occurred recently enough to come within the period of controlled epidemiological study.

The main trends of tuberculosis in the white population of the United States have been ably reviewed by Krause [1]. As he points out, perfectly satisfactory records are lacking, but much that is not definitely proved may be inferred with reasonable probability. As Krause says:

> Brought in by the early settlers, the disease was quite likely held almost under cover during the first short years of natural economy here and there, and for as long as a later sparse agricultural economy existed. Even in the developing villages and towns the disease was likely uncommon. The growing cities began to bring it into notice, but it was not until a manufacturing economy began to be established that it impressed the people as a menace.
>
> This puts us at the opening of the nineteenth century. The foci are numerous; the migrations from country to city are expanding the cities as never before, overcrowding them with hordes, who find themselves immured in dwellings and factories which undoubtedly furnish them much worse living conditions than they had been accustomed to; and the foci of disease enlarge.

Then begins a "setting that would seem ideally designed for the kindling of a conflagration of consumption". With the bulk of population still engaged in farming, a drift to the cities and into the factories developed. Between 1820 and 1840 the proportion of population living in cities nearly doubled. The mill became the dominating factor in social life, with many evils at once attendant. Even the small

* A lecture given on March 10, 1934, before the Medical Association of Puerto Rico.
Received for publication May 21, 1934.

children were sent into the factories in hordes, under the "English system" of employing whole families.

Not enough labor was yet available to supply the demands of industry; so, attracted by the American factory wage, immigration quadrupled, and between 1840 and 1850 Irish alone came in to the number of three quarters of a million. With hordes of new arrivals competing with the native population wages went down, and inevitably with them went standards of living. At the same time, with long hours of labor, work was speeded up, and conditions of factory life became appalling by comparison with modern standards. The air in the working-rooms of the girl operators, according to Dr. Curtis,

> Remains day after day, and even month after month, with only the precarious change which open doors occasionally give. There being no ventilation at night, the imprisoned condition of many of the rooms in the morning is stifling and almost intolerable to unaccustomed lungs. After the day's work is ended . . . . they retire to dormitories scarcely better ventilated than the mills. From four to six and sometimes eight are confined during the night in a single room of moderate dimensions.

As Krause writes, "the nourishing elements of phthisis were at hand". Satisfactory medical data and vital statistics are not available for any period up to the late years of the nineteenth century, but approximations of comparative value can be made. The early physicians, particularly Benjamin Rush, had contrasted the prevalence of consumption in the cities with the freedom from this disease in the forest pioneers. High rates, even 400 or 500 per hundred thousand, have been calculated by statisticians, like Hoffman, for the largest cities at the opening of the century. These were maintained irregularly until about 1835, when a drop developed coincidently with the great influx of young and healthy immigrants, which diluted the population and reduced its tuberculosis rate per unit. But this relative betterment, which lowered the tuberculosis mortality rate to the neighborhood of 300 per hundred thousand, was short-lived. Within a decade, due to the terrible industrial conditions just described, a recrudescence occurred, bringing the rate back to an average of 350, and doubtless much higher in certain industries and localities, where it stayed for another third of a century.

Then, in the 1880's, began a new drop, dramatically coincident with a development of the first magnitude, a public health movement. This occurred at the same time as a new development to which we are apt to attach too much initial importance, the rise of bacteriology and an understanding of the principles of contagion. Before this new knowledge had much effect, a betterment in the conditions of life was apparent, which had a much greater influence. That scientific public health, born in the laboratory, soon came to the support of the general social trend, nobody will deny. But the first reversal of the up grade of tuberculosis came out of the very conditions that had created it, industry itself. To quote once more from Krause:

> Roughly, the second quarter-century of the eighteen-hundreds and the first of the nineteen-hundreds were alike in their main socio-economic trends. Both were characterized by enormous industrial expansion and an accelerated impulse toward urbanization. Both experienced previously unexampled increases of capital. Both gave rise to conditions that brought together and concentrated, as never before, the masses at home and at work.
>
> But how different were the effects on the well-being of the masses, especially in subjecting them to the hazards of tuberculosis! The industrial revolution of the nineteenth century led up to an increase and a greater diffusion of tuberculosis. That of our time is surely smothering it out. In 1850 it was plain that mid-century Industry was the handmaid of tuberculosis; by 1925 it had become certain that modern Industry was checking it.

The giant industrialization of the end of the 19th century and the beginning of the next, with all its faults, has added immeasurably to the comfort and well being of the great majority of workers in the United States, shortening hours of labor, increasing and bettering food supply, improving housing conditions, and improving health conditions in general, in ways which all together have had an unquestionable influence in checking the progress of a disease bound so intimately with bad living as tuberculosis.

One further fact is of great significance. With the new industrialization the old relative hazard of the city, as respects tuberculosis, no longer exists. In colonial history, if we may trust the medical records, the preponderance of the disease was urban, and probably the industrial development of the early and middle parts of the nineteenth century increased the discrepancy. Modern conditions have changed

the situation and in many regions actually reversed it. The situation in the state of New York is an outstanding example of this development. The death rates from all forms of tuberculosis in urban and rural New York in 1932 are given in Table I. While the rate for New York City is slightly higher than that for the rest of the state as a whole, it is distinctly less than that of rural New York, and the average rate for other urban communities than New York City is much lower than that of the rural population.

TABLE I

DEATHS AND DEATH RATES FROM TUBERCULOSIS OF ALL FORMS IN NEW YORK STATE AND NEW YORK CITY IN 1932 [1]

Area	Population estimated as of July 1, 1932	Number of deaths from tuberculosis all forms	Rate per 100,000 population
New York State	13,061,486	7,996	61.2
New York City	7,218,094	4,538	62.9
New York State (exclusive of N. Y. C.)	5,843,392	3,458	59.2
Urban New York[2] (exclusive of N. Y. C.)	3,670,172	1,574	42.9
Rural New York[2]	2,107,515	1,478	70.1
Institutional districts	65,705	406	617.9

[1] Source: New York State Department of Health: SUPPLEMENT TO THE MONTHLY VITAL STATISTICS REVIEW, Vol. XIII. No. 13, March, 1933.

[2] Urban includes cities and other incorporated places whose population was 2,500 or more in the 1930 Census. Rural includes the remainder of the State, consisting of all unincorporated territory and incorporated places under 2,500.

The facts for Europe and comparisons with other continents have been assembled by Flatzeck-Hofbauer [2] in a stimulating monograph with the intriguing title *Kommen und Gehen der Tuberkulose.* He has treated tuberculosis as an epidemic evolving like other epidemics, with ascension, peak and decline, although unlike them in its much longer course. On this curve the nations of the world stand at different points. We have just considered the course of the United States of North America up and down the curve.

Burnet [3], in a compilation on the *Prophylaxis of Tuberculosis,* based on data for the various countries of Europe, makes clear the double part industrialization has played in the course of tuberculosis, favoring its spread in the seemingly inevitable period of exploitation of the worker, and checking that spread rapidly with readjustment of social conditions and betterment of the standard of living.

TUBERCULOSIS IN AMERICAN INDIANS

It is commonly assumed, but without foundation, that this race was free from tuberculosis before the coming of the Europeans. The celebrated Dr. Benjamin Rush, to whom reference has already been made, wrote that consumption was unknown among the Indians, and modeled a system of therapy upon the free, and, as he thought, healthy life of these denizens of the forest. Maher [4] has pointed out the error of Rush's assumption, uncovering numerous references to the existence of pulmonary tuberculosis in the Indians in the writings of the Jesuit Fathers and other travelers of early colonial days. Both the glandular and the chronic pulmonary type of the disease are described. These reports fail to enlighten us as to the first introduction of the disease on American soil, but leave it clear that as early as the first half of the seventeenth century it was already fairly common among the Indians of the Atlantic States and the region of the Great Lakes. However, other references and the reported finding of tuberculosis of the spine in the skeletons of a tribe of Indians never in contact with white settlers, seem to indicate that the disease was already present in the Americas when the Europeans arrived.

Leaving these uncertainties, however, we have abundant evidence that in large sections of the Indian population, even in fairly recent years, tuberculosis, if it existed at all, was a rare disease, and in some of these groups the records are so good that we can trace the course of tuberculization with reasonable assurance.

Out of the many good descriptions of tuberculization of the Indians, I shall choose one where the story is exceptionally clear, viz., the rise and subsequent decrease of tuberculosis among the Indians of the Great Canadian Plains, which has been recorded by Ferguson [5]. Prior to 1860 these Indians had very little contact with the white man. Several white physicians who did live among them for short periods, described their habits and diseases, but made no mention of tuberculosis. In the rare cases where the disease was seen among the aborigines of the region adjacent to the Great Plains, the fact was reported, as in the reference to cases on the Saskatchewan by employees of the Hudson Bay Company in 1797. About 1860 the Indians of the Great Plains

began receiving infected visitors from two sources: Following the Indian troubles in Minnesota in the early 1860's, Indians from regions already tuberculized migrated to the Canadian Plains, and at the same time half-breeds from the tuberculized villages along the Red River began to enter the plains with goods for barter.

The effect of this cannot be determined with exactness, but no great amount of disease appears to have been introduced in this way. At the end of the next decade, however, an abrupt change took place, which immediately introduced tuberculosis on an epidemic scale. This change was coincident with the extermination of the buffalo and entrance of the Indian on the reservations set aside by the white man's government, and by 1880 the Indians had left their free nomad life, entered communities surrounded by whites, with all their diseases, and the children had entered the reservation schools.

They had left their tepees and sites of transient residence for homes of permanent construction. Never noted for attention to hygienic refinement, shut up in houses, the Indians entered on a state of living that can be likened to a laboratory experiment in contagion. The mortality from tuberculosis rose by leaps, as can be learned from reliable records. By 1884 the disease was obviously of epidemic proportions. By 1886 it had attained its peak in certain localities, like the Qu'Appelle valley, where the tuberculosis mortality is calculated to have reached the astounding figure of 9,000 per 100,000, two hundred times the white mortality in that same region today. Elsewhere the disease continued in epidemic proportion, to reach its maximum after 1900, as among the Blackfeet of Alberta, where the decline set in in 1902. After these two decades of unparalleled mortality the death rate from tuberculosis gradually declined, until in 1928, the year of Ferguson's first report, it was 800 per 100,000, still nearly twenty times that of the surrounding white population.

Subsequently, with the introduction of vigorous antituberculosis measures, the tuberculosis mortality rate has dropped still more rapidly. During the years 1931–32 it had reached the figure of 273 per 100,000 among the Qu'Appelle Indians, although the rate for the entire Canadian Indian population of 122,911 was still 547 per 100,000 in 1931, seven and a half times the rate for the total population of Canada.

The infection incidence for the Qu'Appelle Indians is also going down. In 1926–27 the rate of positive reaction to tuberculin was reported as 92 per cent in 374 children of average age of 12.4 years, while for 273 children in the same schools in 1933, of the same average age, the rate was 63 per cent. Inasmuch as the infection incidence on admission was about the same in 1927 and 1933 (about 7 per cent) the chief saving from infection seems to have occurred in the schools.

A significant feature of the rise and wane of the epidemic was a shift in the age incidence of maximum mortality from early childhood to early adolescence. In a community of heavy tuberculization, this phenomenon can most reasonably be interpreted pathologically as a shift from a maximum mortality due to progressive tuberculosis of the primary or childhood type to a maximum rate from tuberculosis of the reinfection or adult type, occurring in the acute form of adolescence.

All anatomical types were indeed seen, glandular, pulmonary, osseous and miliary, with a predominance of the glandular or scrofulous type in the early years. During the first two decades of the epidemic one child out of three had swollen caseous and discharging glands, including axillary and inguinal as well as cervical glands. In the same region today glandular tuberculosis is becoming rare. Instead of 33 per cent, only 3 per cent of 500 school and pre-school children examined shortly before Ferguson's report in 1928, had tuberculous glands, and in the Qu'Appelle schools in 1932 the rate had receded to less than one per cent.

Notable as was this epidemic from the point of view of contagion and spread, it had almost equal significance for studies in heredity. Certain families could be followed through three generations after the onset of the epidemic. In 69 family trees studied one-half died out within the three generations. While the elimination was due only in part to tuberculosis, it is noteworthy that in the eliminated families 31 per cent of the deaths were certified as due to tuberculosis and in the surviving families only 19 per cent.

As far as the rest of the North American Indians are concerned, we have similar records that give us confidence in reconstructing the history of other tribes on the same basis. The figures recently compiled by Burns [6] for eighteen

western and middle western states in the United States, in 1925, are as follows (Table II):

TABLE II

Estimated Indian population	Total deaths			Deaths from tuberculosis		
		Rate per 100,000			Rate per 100,000	
	Indian	Indian	U. S. registration area	Indian	Indian	U. S. registration area
180,884.....	4,629	2,560	1,180	1,132	630	87

The tuberculosis mortality rate is much like that given by Ferguson for Canada and about eight times the white rate for the country as a whole.

We have good reason to believe that tuberculosis was introduced among the Indians in the Spanish colonies at a very early date, if it was not already there. In the first years of European colonization its presence was recorded. Many of you are familiar with the short but significant note, concerning Puerto Rico itself, from the pen of that great historian of the Indies, Fray Bartolomé de las Casas (I have taken the reference from a paper by García de Quevedo [7]), who wrote, "These Indians are unable to do heavy work, and when they are confined they soon become emaciated and die throwing out blood from the mouth (*Estos Indios no pueden hacer trabajos fuertes, y cuando se les encierra, enferman, pronto enflaquecen y mueren echando sangre por la boca*").

This could hardly refer to any other malady than tuberculosis. It also would appear to be tuberculosis of the reinfection type, not the tuberculosis of first infection, which is likely to have quite different manifestations. The conditions described by Las Casas in his *Historia de las Indias* seem ideal for the propagation of tuberculosis, whether the disease was already existent in the islands or introduced by the incoming Spaniards, seeking the gold locked in the hills of the Caribbean islands or washed into the beds of their streams. In the mines driven into the mountain slopes the opportunities for contagion must have been greatest. Underfed, laboring long hours in the dark, wet galleries, the impressed Indians

died off at a frightful rate, and when they escaped and fled to their homes they carried the seeds of disease with them, to which whole families succumbed. In the once populous island of Santo Domingo within a decade two-thirds of the original inhabitants died off (*"donde siempre andaban huidos, y se escondian, vino sobre ellos tanta de enfermedad, muerte y miseria de que murieron infelicemente de padres y madres y hijos, infinitos. Por manera que, con las matanzas de las guerras, y por las hambres y enfermedades que procedieron por causa de aquellas, y de las fatigas y opresiones que después sucedieron, y miserias, y sobre todo mucho dolor intrínseco, angustia y tristeza, no quedaron de las multitudes que en esta Isla, de gentes, había, desde el año de 94 hasta el de 6, según se creía, la tercera parte de todas ellas"*).

In the depopulation famine, small-pox, dysentery and other diseases played a great part, but there is good reason to believe that tuberculosis took a heavy toll also. The unhappy state of famine and disease was not confined to the Indians. Chronic illness infested the colonists, and every opportunity was afforded for transfer of contagious disease to the Indians. Take this instance as an example. Bartolomé Colón on returning to the city of Isabella found 300 of the colonists dead from various diseases, and much sickness among the remainder. To save the latter he decided to send the sick and weak to the city of Santo Domingo and to the various Indian towns thereabout, where if they could not have medical attention, they could at least obtain food from the Indians, and have only disease to combat, and no longer disease combined with famine (*"determinó de repartir y enviar todos los enfermos y flacos por las fortalezas que había desde la Isabela hasta Santo Domingo, y a los pueblos de los indios que cerca dellas estaban, porque al ménos ternian, si no médicos y boticarios, comida que los indios les darian y no les faltaria, y así pelearian solamente con la enfermedad, y no con ella y juntamente con la hambre"*). What ideal conditions for the spread of infection were inherent in this plan!

Another vivid chapter is devoted by Las Casas to the depopulation of the island of Jamaica. Over and again the story must have been repeated in the littorals of the Caribbean, on the West Coast of South America and in the Andes. In the Bolivian mountains are said to be ten thousand abandoned silver mines of the Spanish days. Three